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AUTHOR(S):

Brinckmann-Voss, Anita; Arai, Mary Needler;
Nagasawa, Kazuya

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***Leuckartiara acuta* (Hydrozoa, Anthoathecatae, Pandeidae),
a New Species from the Pacific**

ANITA BRINCKMANN-VOSS¹⁾, MARY NEEDLER ARAR²⁾ and KAZUYA NAGASAWA³⁾

¹⁾Department of Natural History, Royal Ontario Museum, Toronto, Canada
and P.O.Box 653, Sooke, British Columbia, V0S 1N0, Canada

²⁾Pacific Biological Station, 3190 Hammond Bay Road, Nanaimo,
British Columbia, V9T 6N7, Canada and Department of Biological Sciences,
University of Calgary, Calgary, Alberta, Canada

³⁾Department of Bioresource, Science,
Graduate School of Biosphere Science, Hiroshima University,
1-4-4 Kagamiyama, Higashi-Hiroshima 739-8528, Japan and
National Research Institute of Far Seas Fisheries,
5-7-1 Shimizu-Orido, Shizuoka 424-8633, Japan

Abstract *Leuckartiara acuta* sp. nov., family Pandeidae (Anthoathecatae, Hydrozoa) has been collected during surveys of epipelagic salmon habitat in the northern Subtropical Region and the Transitional Domain of the Subarctic Region of the North Pacific. It is characterized by a tall, pointed, narrow, apical projection, four periradial tentacles and two or three tentaculæ in each quadrant. Reexamination of specimens recorded from the Subtropical Region of the central North Pacific by Kramp (1965) as *L. gardineri* shows that these specimens also belong to the new species.

Key words: *Leuckartiara*, Anthoathecatae, Hydrozoa, Cnidaria, taxonomy, distribution

Introduction

During surveys of the epipelagic salmon habitat of the North Pacific specimens of a species of the family Pandeidae were collected in the northern Subtropical Region and the Transitional Domain of the Subarctic Region between the date line and Japan. The species belongs in the genus *Leuckartiara* Hartlaub, 1914, but differs from any previously described species. The present paper constitutes a description of the new species, *Leuckartiara acuta* sp. nov. Previous papers such as Kramp (1965) and Hirohashi (1988) had reported *L. gardineri* Browne, 1916 in the North Pacific. The Kramp (1965) specimens were obtained and reexamined, and were found to also belong to the new species.

Material and Methods

Samples were collected by Japan-U.S. Cooperative High-Seas Salmon Research Cruises in June of 1995 and 1996 along a South to North transect line at 179°30'W longitude from 38°30'N to 58°30'N latitude in the central North Pacific Ocean and Bering Sea, at transit stations en route to the fishing area along a line at 40°00'N latitude, and returning to Hokkaido, Japan from the Bering Sea (Davis et al, 1996; Nagasawa and Ishida, 1997a)(see Fig. 1). In July of each year a North to South line at 165°00'E was also sampled (Nagasawa and Ishida, 1997b). Similar collecting trips were conducted in 1997 and 1998 (Nagasawa and Ishida, 1998, 1999), together with one in February 1998 which sampled shorter portions of both lines (Nagasawa, 2000). In April of 1995 a single specimen was obtained at 40°00'N, 136°00'E in the Japan Sea (Ishida, 1996).

Samples were collected using a remodeled Norpac net (0.45 m diameter opening, 1.95 m length, and 0.335 mm mesh size). The net was towed vertically from 150 m depth to the surface at night. The samples were fixed in 10% formalin in sea water. Preliminary sorting was carried out at the National

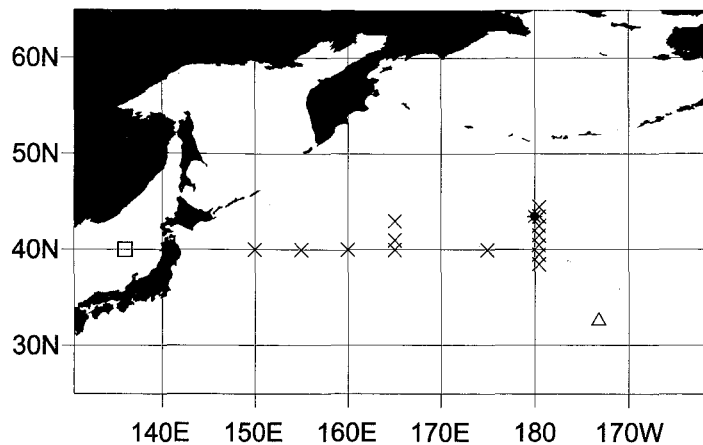


Fig. 1. Map of locations at which *Leuckartiara acuta* sp. nov. have been collected. Triangle: North Pacific, May 1933. Square: Japan Sea, April 1995. Crosses: North Pacific, June and July 1995-1996. Filled circle with superimposed crosses: North Pacific, February 1998.

Research Institute of Far Seas Fisheries, Shimizu-Orido, Shizuoka. Coelenterates were sorted by M. N. Arai, and over 80 pandeoid specimens collected in the North Pacific in 1995 and 1996 and the specimen from the Japan Sea were provided to A. Brinckmann-Voss for taxonomic work (see Fig. 1 for locations). Subsequent sorting of collections from summers of 1997 and 1998 yielded further specimens from the same locations as the first two summers. A single specimen was collected on February 22, 1998 from 43°30'N, 180°00' (Fig. 1).

Specimens reported by Kramp (1965) as *Leuckartiara gardineri* were lent to us by the Zoological Museum, Copenhagen, Denmark. The lot was collected at the "Selandia" station 4788 (32°50'N, 173°10'W) on 17 May 1933 (Fig. 1). Specimens of *Leuckartiara gardineri* and *L. simplex* were lent to us by the Institut Royal des Sciences Naturelles de Belgique. J. Bouillon collected the *L. gardineri* in 1979 and 1980 off Laing Island, Hansa Bay, Madang Province, Papua New Guinea, and the *L. simplex* in 1981 from the same location.

Figure 1 was drawn by M. Arai with the assistance of M. Theiss; Figures 2-6 were photographed or drawn by A. Brinckmann-Voss.

Description

Leuckartiara acuta sp. nov.

Leuckartiara gardineri Kramp, 1965: 32 (in part; not *L. gardineri* Browne 1916)

Diagnosis: *Leuckartiara* with long, narrow apical projection, four periradial tentacles and two or three tentaculæ in each quadrant.

Type Material: Holotype: One specimen (Figs. 2a, 3, 6b) collected at 40°00'N, 160°00'E, June 11, 1996, vertical tow from 150 m depth to surface, deposited in Showa Memorial Institute, Tsukuba Research Center, National Science Museum, 4-1-1 Amakubo, Tsukuba-city, Ibaraki 305-0005, Japan, registration number NSMT-Co S11.

Paratypes: 14 specimens from the same location and collection as the holotype, deposited in Showa Memorial Institute, registration numbers NMST-Co S12-25; 5 specimens from single collection, 40°00'N, 165°00'E, June 12, 1996, vertical tow from 150 m depth to surface deposited in

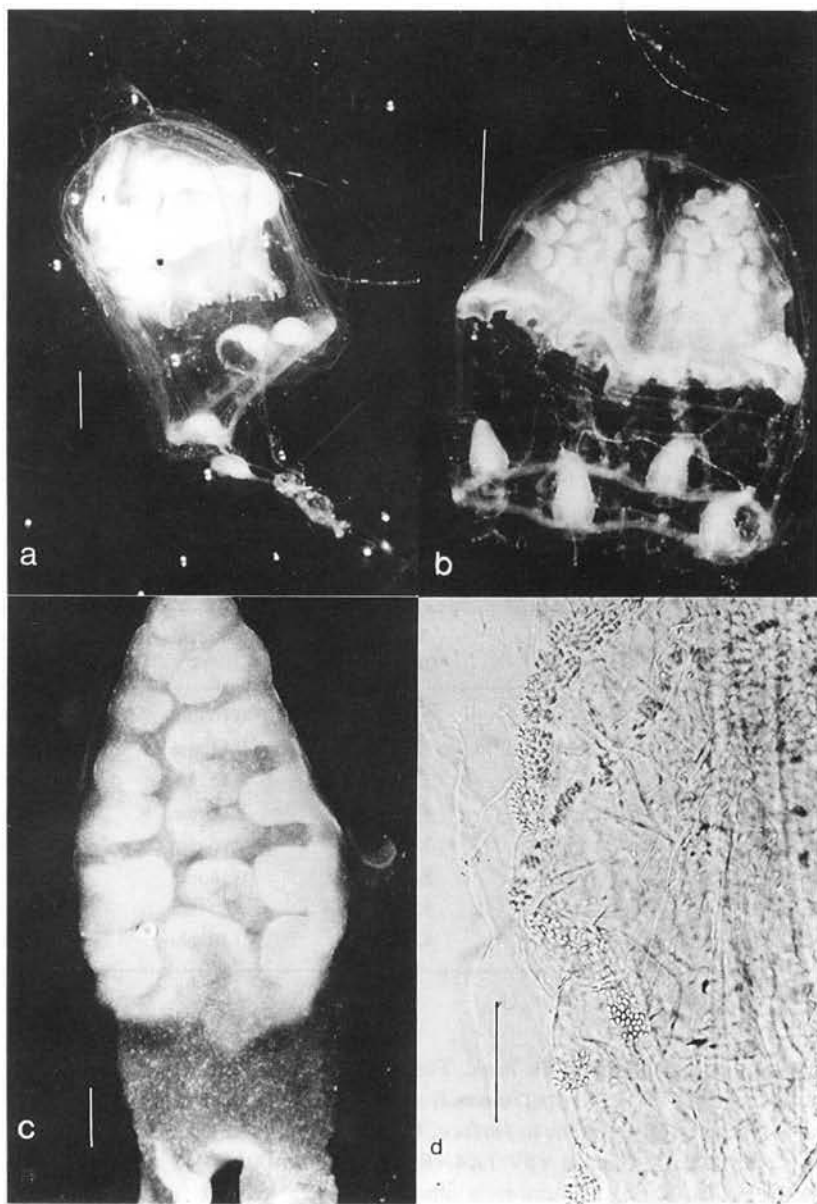


Fig. 2. *Leuckartiara acuta* sp. nov.; a. holotype, sex unknown. Scale 1 mm; b. a female paratype. Scale 1 mm. c. female gonad on one quadrant of manubrium. Scale 0.25 mm. d. cnidocyst clusters on exumbrellar cnidocyst track. Scale 100 μ m. b-d are from different specimens of paratypes but from the same collection as the holotype.

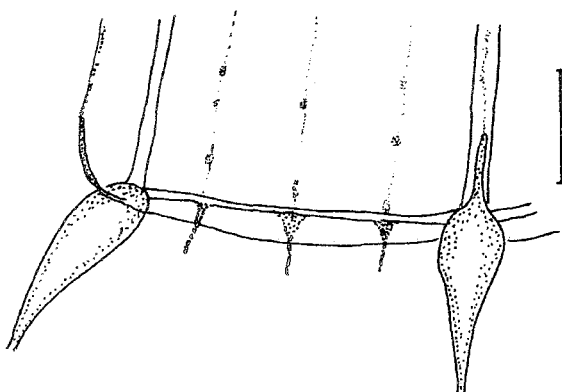


Fig. 3. Schematic diagram of the umbrellar margin of the *Leuckartiara acuta* holotype. Scale 0.4 mm.

Table 1. Dimensions of several fixed specimens of *Leuckartiara acuta* collected from two locations June 11, 1996. As apical projections are often folded, exumbrellar measurements do not include the apical projection, which in most specimens is approximately half the height of the remaining exumbrella. The tallest specimen included is the holotype.

Location	Height exumbrella	Width exumbrella	Width radial canal	Width ring canal
40° N, 160°E	3.0 mm	3.1 mm	0.16 mm	0.12 mm
40° N, 160°E	3.2 mm	2.6 mm	0.14 mm	0.12 mm
40° N, 160°E	3.2 mm	2.6 mm	0.16 mm	0.10 mm
40° N, 155°E	3.2 mm	4.0 mm	0.28 mm	0.12 mm
40° N, 160°E	3.4 mm	3.0 mm	0.16 mm	0.12 mm
40° N, 160°E	4.0 mm	3.0 mm	0.16 mm	0.12 mm
40° N, 160°E	4.0 mm	3.0 mm	0.16 mm	0.12 mm
40° N, 160°E	4.8 mm	4.1 mm	0.16 mm	0.12 mm

Royal Ontario Museum, 100 Queen's Park, Toronto, Ont., Canada M5S 2C6. (ROMIZ B 3540; accession number 24004-002); 10 specimens from single collection, 40°00'N, 155°00'E, June 11, 1996, vertical tow from 150 m depth to surface, deposited in Royal British Columbia Museum, 675 Belleville St., Victoria, B.C., Canada V8V 1X4. (RBCM 004-40-001).

Holotype (Figs. 2a, 3, 6b). Exumbrella other than apical projection slightly higher than wide: height 4.8 mm; width 4.1 mm. Apical projection narrow, pointed, height 2.6 mm (Fig. 6b). Four perradial marginal tentacles with club-like tentacle bulbs, with short visible spurs; tentacle bulbs not laterally compressed. Between each pair of tentacles three small triangular bulbs with short tentaculae. (Fig. 3). Very thin lines with separated elongated clusters of cnidocysts running vertically on the exumbrella and even onto the apical projection. Lines appear faint under low magnification, but become identifiable under higher magnification (Fig. 3). Ring canal cord-like (width 120 μ m); radial canals ribbon-like (width 160 μ m), edges smooth, forming thin triangular slits in the "mesenteries"

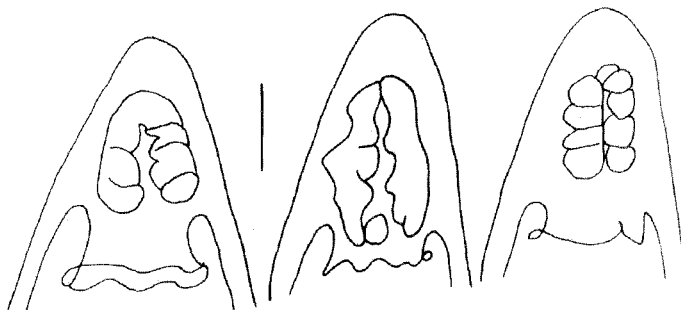


Fig. 4. *Leuckartiara acuta* sp. nov. Outlines of gonads on one interradius each of three different specimens to show the varying patterns of folds forming incomplete horseshoes. Scale 0.6 mm.

attaching the manubrium to the subumbrella, and entering the stomach at its mid-height, thus forming triangular subumbrellar pockets in each quadrant. Manubrium wide, occupying about half of the subumbrellar cavity; mouth wide with no conspicuous neck-like narrowing of the manubrium towards its opening. Lips with few irregularly shaped frills. Gonads interrarial, forming irregular folds or knobs resembling a horseshoe or part of it; sex unknown.

Other specimens (Figs. 2b, 2c, 2d, 4). Height of exumbrella other than apical projection greater or less than the width in preserved specimens (see Table 1). Apical projection often damaged and folded in preserved specimens, but always narrow and distinctively pointed; in most specimens approximately half the height of the remaining exumbrella. Four perradial marginal tentacles, with short abaxial spurs usually not more than 1/10 the height of the exumbrella, with club-like tentacle bulbs, ocelli not discernible in preserved specimens; between each pair of tentacles two or three small triangular bulbs with short tentaculæ, the interrarial bulb being slightly larger than the adradial ones. The ring and radial canals resemble those of the holotype, with the radial canals flatter and wider than the ring canal (Table 1). The perradial "mesenteries" delimit four triangular subumbrellar pockets as is typical of members of this genus (see Russell, 1953 p. 6). The manubrium filling only half, rarely more, of the subumbrellar cavity with a broad mouth. Some of the specimens could be identified as female showing eggs or planulae in their gonads; other specimens without visible eggs are probably male or immature. The shape of the gonads may vary substantially among specimens (Figs. 2b, 2c, 4): some show a complete horseshoe shape with gonads folded inwards (Fig. 4), others have an extra row of gonad folds within the horseshoe (Fig. 2c), and yet others are just an assemblage of ridges and knobs arranged more or less like a horseshoe (Fig. 2b). Velum present, but often damaged in preserved specimens.

Cnidae measured from tentacles: microbasic euryteles, length/width $7.3/5 \mu\text{m}$ (n: 10). Cnidae examined from tentacles, lips and exumbrella showed no significant differences of shape or size.

Etymology

This species has been named with reference to its conspicuous but narrowly pointed apical projection.

Distribution

In the present study specimens were obtained from $136^{\circ}00'E$ to $179^{\circ}30'W$ at latitude $40^{\circ}00'N$, as well as from $38^{\circ}30'N$ to $44^{\circ}30'N$ at longitude $179^{\circ}30'W$, and from $40^{\circ}00'N$ to $43^{\circ}00'N$ at longitude $165^{\circ}00'E$. i.e. from the Subtropical Region and the Transitional Domain of the Subarctic Region of the

North Pacific and the Japan Sea (Fig. 1). The "Selandia" specimens were obtained from 32°50'N, 173°10'W (Fig. 1).

Remarks

The medusa described in this paper has most of the characters attributed to the genus *Leuckartiara* Hartlaub, 1914, family Pandeidae, by previous authors. As described above the species has a long apical projection, a large manubrium connected to radial canals by "mesenteries", four broad ribbon-like radial canals, and four well developed marginal tentacles when adult. It lacks

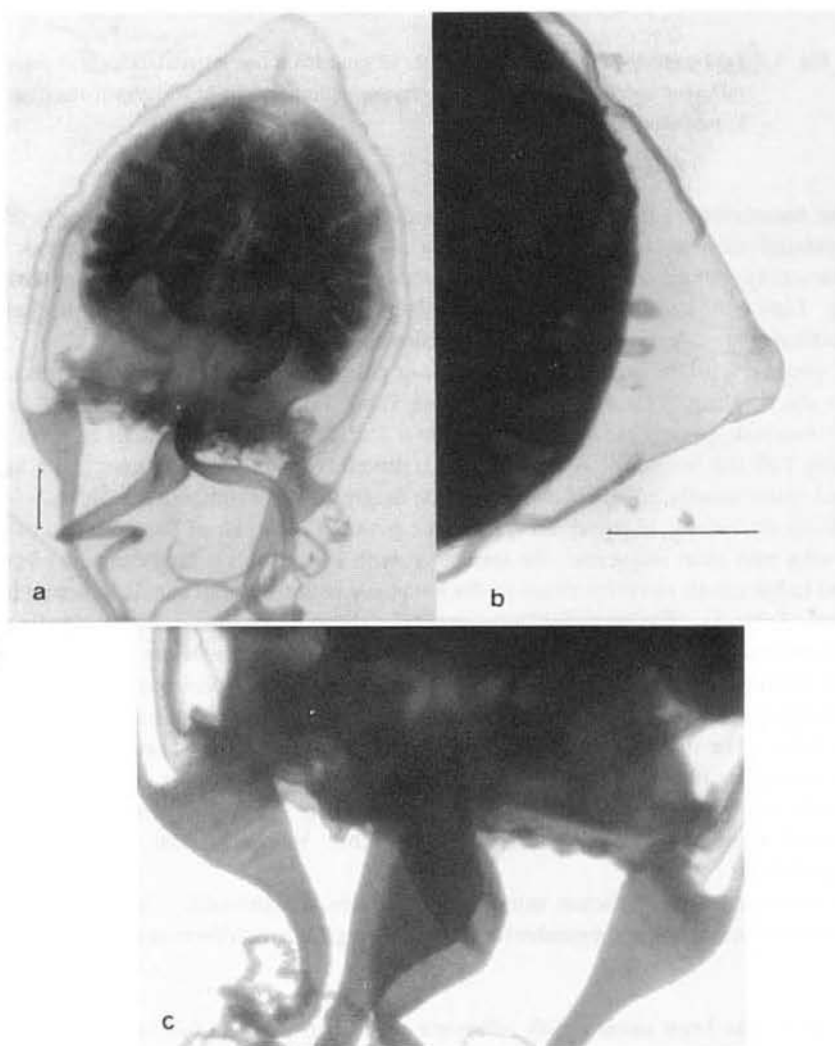


Fig. 5. *Leuckartiara gardineri* Browne, 1916. Hansa Bay, Madang Province, Papua New Guinea. a. entire animal. Scale 1 mm. b. apex of umbrella showing wide angle of the short apical projection and upper ends of cord-like exumbrellar spurs. c. umbrella margin with four perradial tentacle bulbs and small interradial and adradial bulbs. Scale figures b and c 1 mm (included with figure b).

diverticulae of the radial canals, marginal cirri, or manubrial lobes. Although the gonads are often very irregular in this species, "horseshoe" gonads, still attributed by several authors to the genus *Leuckartiara* (see for example Schuchert, 1996), are not a necessary character for the genus. Gonad structure is variable between and within species and distinct interradian connections between the adradial portions of the gonad to form a "horseshoe" are lacking in *Leuckartiara foersteri* Arai and Brinckmann-Voss, 1980 and *L. brownei* Larson and Harbison, 1990.

When *Leuckartiara* was summarized by Kramp (1961a, 1965, 1968) he included seven adult species; *L. octona* (Fleming, 1823), *L. nobilis* Hartlaub, 1913, *L. gardineri* Browne, 1916, *L. hoepplii*, Hsu, 1928, *L. grimaldii* Ranson, 1936, *L. zaca* Bigelow, 1940 and *L. annexa* Kramp, 1957, as well as *L. brevicornis* Murbach and Shearer, 1902 subsequently transferred to *Neoturris* by Arai and Brinckmann-Voss (1980b). Since that time a further six species have been described; *L. simplex* Bouillon, 1980, *L. foersteri* Arai and Brinckmann-Voss, 1980, *L. eckerti* Bouillon, 1985, *L. brownei* Larson and Harbison, 1990, *L. orientalis* Xu, Huang and Chen, 1991, *L. adnata* Paglès, Bouillon and Gili, 1992 (Bouillon, 1980; Arai and Brinckmann-Voss, 1980a; Bouillon, 1985; Larson and Harbison, 1990; Xu *et al.*, 1991; Paglès *et al.*, 1992). Of these 13 species *L. acuta* most resembles *L. simplex* and *L. gardineri*.

L. simplex differs from *L. acuta* in possessing laterally compressed marginal bulbs, one interradian bulb and no adradial bulbs per interradian and a large flask-shaped manubrium extending nearly to the velar opening (see Bouillon, 1980). We confirmed these characters by examination of specimens of *L. simplex* from off Papua New Guinea.

L. gardineri (Fig. 5) resembles *L. acuta* in possessing small interradian and adradial tentaculae between the 4 perradian tentacles (Browne, 1916; Kramp, 1953; 1961b; Bouillon, 1980) (compare Fig. 3 with Fig. 5c). However the two species are distinguished by several other morphological characters: The apical projection is just the inconspicuous tip of a rather triangular bell in *L. gardineri* (Figs. 5b,

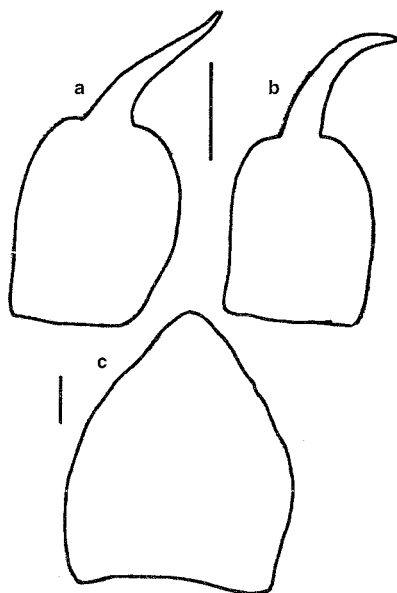


Fig. 6. Outlines of the exumbrella of a: *Leuckartiara acuta* from "Selandia" collection, identified as *Leuckartiara gardineri* by Kramp (1965), p. 33; b: *Leuckartiara acuta* holotype; c: *L. gardineri* from Hansa Bay, Papua New Guinea. Scale a, b: 2.5 mm; c: 1 mm.

6c) but a pointed, slender, structure in *L. acuta* (Figs. 6a, 6b). The manubrium extends to near the velar level with a clear constriction near its mouth in *L. gardineri*, but fills only approximately half, rarely up to two thirds, of the subumbrellar cavity with no narrowing towards the mouth in *L. acuta*. Cordlike exumbrellar spurs extend from the tentacle bulbs to near the apex of the bell of *L. gardineri* (Figs. 5a, 5b), whereas in *L. acuta* spurs are short (less than 1/10 the height of the exumbrella) and thin and in addition there are long, thin vertical lines - interspersed with nematocyst clusters (Fig. 2d, 3) - leading from the marginal bulbs up and onto the apical projection.

Kramp (1965) reported several specimens of *L. gardineri* collected from the Central North Pacific at the "Selandia" Station 4788 (32°50'N, 173°10'W) on May 17, 1933, but noted that their occurrence in that region was "very peculiar". We reexamined those specimens from Kramp's collections, and identified them as clearly belonging to the new species *L. acuta*. In Figure 6 an outline of an exumbrella of a "Selandia" specimen is compared with those of *L. gardineri* and *L. acuta*.

In a masters thesis Hirohashi (1988) reported *L. gardineri* in samples collected between 150 m depth and the surface along a transect at 180° longitude in June to August 1986. The *Leuckartiara* specimens were common in subtropical samples, i.e. from samples collected between 37° and 41°N. It was not possible to obtain these samples to recheck the species identification as would have been desirable in light of our present work.

All of the North Pacific specimens of *Leuckartiara acuta* examined in this study were obtained from the Subtropical Region and the most southern Transitional Domain of the Subarctic Region (Fig. 1). Definitions of the boundaries between regions and domains of the North Pacific are included in Favorite et al (1971). The subarctic boundary with the Subtropical Region is defined by the somewhat variable location of the 34‰ isohaline in the surface layer and lies farther north at the date line than near Japan. Lying immediately north of this boundary the Transitional Domain of the Subarctic Region widens as it runs from Japan toward the date line. Tows made even further north through the Western Subarctic Domain and into the Bering Sea in 1995-1998 did not yield specimens, so it is very unlikely that the range of *Leuckartiara acuta* extends farther north than the Transitional Domain. It is, however, unclear how far south the range might extend since that area was not collected in 1995-1998. The "Selandia" collection extends the range southward only to 32°50'N (Fig. 1).

The specimens collected in the present investigation were obtained from the upper 150 m of the water column because the investigators were concentrating on salmon habitat. The "Selandia" specimens were collected with 220 m of wire out. However, it is not known whether the species is only epipelagic, since this area of the North Pacific has not been intensively collected below these depths. Most of the specimens examined were obtained by tows made in June and July. The season begins much earlier as shown by the single specimen collected on February 22 and the "Selandia" specimens collected on May 17. They have not as yet been found in late summer or autumn but few collections have been made in those periods.

The locations where species were collected were on the high seas away from the continental shelves. In the pandeid life cycles many instances are known of hydroids which are associated with other animals. This character of the hydroids found in pandeids may make it possible for their medusa stage to inhabit the high seas.

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